

2B Centre of Mass of a Set of Particles Arranged in a Plane

For particles arranged in a plane, consider the x- and y-coordinates separately:

1. Find the coordinates of the centre of mass of the following system of particles:

2 kg at (1, 2); 3 kg at (3, 1); 5 kg at (4, 3)

Method 1 (taking moments about each axis):

Method 2 (using position vectors):

Key result using position vectors (masses $m_1, \dots, m_n$ with position vectors $r_1, \dots, r_n$):

2. Find the coordinates of the centre of mass of the following system of particles:

4 kg at (-1, 3); 2 kg at (-2, -4); 8 kg at (4, 0); 6 kg at (1, -3)

If a question does not specify axes or coordinates:

3. A light rectangular plate ABCD has $AB = 20$ cm and $AD = 50$ cm. Particles of masses 2 kg, 3 kg, 5 kg and 5 kg are attached to the plate at the points A, B, C and D respectively. Find the distance of the centre of mass of the loaded plate from:
- a) AD
 - b) AB
4. Particles of masses 4 kg, 3 kg, 2 kg and 1 kg are placed at the points (x, y) , $(3, 2)$, $(1, -5)$ and $(6, 0)$ respectively. Given that the centre of mass of the four particles is at the point $(2.5, -2)$, find the values of x and y .
5. Three particles of masses 2 kg, 1 kg and m kg are situated at the points $(-1, 3)$, $(2, 9)$ and $(2, -1)$ respectively. Given that the centre of mass of the three particles is at the point $(1, \bar{y})$, find:
- a) the value of m
 - b) the value of $\bar{y}$.